COURSE DATA

Data Subject	
Code	34154
Name	Mathematical programming
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Faculty of Mathematics	2	First term

Subject-matter

Degree	Subject-matter	Character
1107 - Degree in Mathematics	4 - Mathematical programming	Obligatory

Coordination

Name	Department
CORBERAN SALVADOR, ANGEL JOSE	130 - Statistics and Operational Research
PEIRO RAMADA, JUAN JOSE	130 - Statistics and Operational Research

SUMMARY

This course presents an introduction to Mathematical Programming. The main aim of the course is that students learn to formulate and solve real systems using mathematical models in the context of optimization : linear, integer and non-linear. The course has an applied nature, with particular attention to methods and solvers.

The program is divided into three parts corresponding to the three models. The first part contains Linear Programming and its extensions. In the second part we study the Integer Linear Problem, this is the particular case when the variables are integers. Classical structured problems and resolution methods are introduced, studying their efficiency. In the last part of the course, we study Nonlinear Programming restricted and unrestricted: specifically, two general models of this discipline are introduced.

Finally, we note the use of computer packages in practical classes. In particular we will work with the LINGO program to learn to formulate and solve optimization problems.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Have approved the subjects Linear Algebra and Discrete Mathematics.

OUTCOMES

1107 - Degree in Mathematics

- Capacity for analysis and synthesis.
- Capacity for organization and planning.
- Solve problems that require the use of mathematical tools.
- Ability to work in teams.
- Apply the knowledge in the professional world.
- Argue logically in decision-making.
- Expressing mathematically in a rigorous and clear manner.
- Capacity of abstraction and modeling.
- Participate in the implementation of software and learn mathematical software.
- Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.
- Visualize and interpret the solutions obtained.

LEARNING OUTCOMES

- To Know the Operation Research area and its applications.

- To know how to use the Linear Programming model, its mathematical basis and how to use the basics tools to solve and analyse different problems using Simplex Algorithm, Duality and sensitivity analysis.

- To know integer Linear Programming, its applications, complexity and the main algorithms.

- To know some flow networks.

- To know basic knowledge in Nonlinear Programming and its resolution methodologies.

DESCRIPTION OF CONTENTS

1. Introduction

Introduction to Operations Research.
The optimization problem.
Linear Programming Model.

2. The simplex method

Convex sets and polyhedrons.
Simplex Methodology.
Initial solution and convergence.

3. Duality

Duality Theory.
Dual Simplex Method.
Sensitivity Analysis.

4. Introduction to the Integer Linear Programming

Integer Linear Programming.
Structure Problems in Combinatory Optimization.

5. ILP algorithms

Cutting-Plane Method.
Branch and Bound Method.

6. Nonlinear programming

Introduction to Non linear Programming.
Resolution algorithms.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	37,50	100
Computer classroom practice	22,50	100
Other activities	7,50	100
Attendance at events and external activities	2,00	0
Development of group work	5,00	0
Development of individual work	10,00	0
Study and independent work	12,00	0
Readings supplementary material	2,00	0
Preparation of evaluation activities	12,00	0
Preparing lectures	20,00	0
Preparation of practical classes and problem	13,00	0
Resolution of case studies	7,00	0
TOTAL	**150,50**	

TEACHING METHODOLOGY

In the lectures, the concepts and methods of mathematical programming will be introduced, accompanying examples and proposed exercises.

For the preparation of the course the student will have a collection of problems that they will have to solve on their own.

The practical sessions will be synchronized with the teory. These sessions provide the students and opportunity to deepen practical understanding regarding the issus covered. The students will use a commercial code to solve problems with specific date and interpret the results.

Tutoring sessions will serve small group to discuss and focus the concepts seen so far.

EVALUATION

The educational evaluation of knowledge and and skills achieved by students will ocntinuously througthout the course, and consist of the following blocks of evaluation:

1. Exercises and the class work submitted during the course and/or partial exams : 30 % of the final grade, of which 10 % are seminars/tutorials.

2. Final exam: 70% of the final grade.

Grades earned in paragraph 1 **shall be kept in the two examination sittings of the academic year in which the were made and cannot be retaken**, since its evaluation is only possible in the teaching period.

REFERENCES

Basic

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Referencia b1: Bazaraa, M., Jarvis, J. y Sherali, H., Linear Programming and Network Flows. Wiley (1990).

Referencia b2: Cunningham, K. And Schrage, L., Manual del Lingo. Lindo Systems Inc. (1990).

Referencia b3: Garfinkel, R. and Nemhauser, G., Integer Programming. Wiley Interscience (1972)

Referencia b4: Papadimitriou, C. and Steiglitz, K., Combinatorial Optimization: Algorithms and Complexity. Prentice Hall (1982).

Referencia b5: Williams, H., Model Building in Mathematical Programming. Wiley (1990).

Referencia b6: Winston, W.L., Introduction to Mathematical Programming: Applications and Algorithms. Duxbury Press (1995).

Referencia b7: Wolsey, L.A., Integer Programming, Wiley Interscience (1998).

Referencia b8: Schrage, L., Optimization Modelling with LINDO. Duxbury Press (1997).

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Additional

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Referencia c1: Calvete Fernández, H. I. y Mateo Collazos, P. M.: Programación Lineal, Entera y Meta. Problemas y Aplicaciones. Prensas Universitarias de Zaragoza (1994).

Referencia c2: Hillier, F.S. y Lieberman, G.J.: Introducción a la Investigación de Operaciones. McGraw-Hill (1991).

Referencia c3: Murty, K.G.: Linear and Combinatorial Programming. Wiley (1976).

Referencia c4: Ríos Insua, S., Ríos Insua, D., Mateos, A. y Martín, J.: Programación Lineal y Aplicaciones. RaMa Textos Universitarios (1997).

Referencia c5: Salazar, J.J., Lecciones de Optimización. Manuales y Textos Universitarios. Universidad de La Laguna (2000).

Referencia c6: Taha, H., Investigación de Operaciones. Pearson, Educación (2004).

Referencia c7: Vanderbei, R.J., Linear Programming. Foundations and Extensions. Kluwer (2001).

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available

En caso de que se produzca un cierre de las instalaciones por causas sanitarias que afecto total o parcialmente las clases de la asignatura, estas serán sustituidas por sesiones no presenciales siguiendo los horarios establecidos. Si el cierre afectara alguna prueba de evaluación presencial de la asignatura, esta será sustituida por una prueba de naturaleza similar que se realizará en modalidad virtual a través de las herramientas informáticas soportadas por la Universitat de València. Los porcentajes de cada prueba de evaluación permanecerán invariables, según aquello establecido por esta guía.